

**UNITED STATES DISTRICT COURT
FOR THE MIDDLE DISTRICT OF PENNSYLVANIA**

HAN TAK LEE,	:	Civil No. 4:08-CV-1972
	:	
Petitioner	:	(Judge Nealon)
	:	
v.	:	(Magistrate Judge Carlson)
	:	
FRANKLIN J. TENNIS,	:	
Superintendent, et al.,	:	
	:	
Respondents	:	

REPORT AND RECOMMENDATION

I. Introduction

“Slow and painful has been man’s progress from magic to law.”

This proverb, inscribed at the University of Pennsylvania Law School on the statue of Hseih-Chai, a mythological Chinese beast who was endowed with the faculty of discerning the guilty, is a fitting metaphor for both the progress of the law and the history of this case. The law is the means by which fragile, frail, imperfect persons and institutions seek greater perfection and justice through the search for the truth. But the search for the truth is not always easy, and the path to the truth is not always clear. Sometime we find that truth eludes us. Sometimes, with the benefit of insight gained

over time, we learn that what was once regarded as truth is myth, and what was once accepted as science is superstition.

So it is in this case.

In 1990, Han Tak Lee was convicted in the Court of Common Pleas of Monroe County of arson and murder in connection with the death of his daughter, Ji Yun Lee, in a tragic cabin fire at a religious retreat. Lee's trial and conviction was based, to a substantial degree, upon what was at the time undisputed scientific evidence concerning the source and origin of this fire, fire origin evidence which tended to show that the fire which consumed this cabin and took the life of Ji Yun Lee was deliberately set by the defendant in a calculated fashion. Today, with the benefit of extraordinary progress in human knowledge regarding fire science over the past two decades it is now uncontested that this fire science evidence—which was a critical component in the quantum of proof that led to Lee's conviction—is invalid, and that much of what was presented to Lee's jury as science is now conceded to be little more than superstition.

On these facts we find that Lee has “show[n] that the admission of the fire expert testimony ‘undermined the fundamental fairness of the entire trial,’ Keller v. Larkins, 251 F.3d 408, 413 (3d Cir. 2001), because ‘the probative value of [the fire expert] evidence, though relevant, is greatly outweighed by the prejudice to the accused from its admission.’ Bisaccia v. Attorney Gen., 623 F.2d 307, 313 (3d Cir.1980) (quoting

United States ex rel. Bibbs v. Twomey, 506 F.2d 1220, 1223 (7th Cir.1974)).” Han Tak Lee v. Glunt, 667 F.3d 397, 403 (3d Cir. 2012). Therefore, for the reasons set forth below, we recommend that the petition for writ of habeas corpus be conditionally granted and that this matter be remanded to the Court of Common Pleas of Monroe County with instructions to provide Lee with a new trial on these charges.

II. Statement of Facts and of The Case

A. The State of Fire Science in 1989 and the Development of Fire Science Since 1989¹

The prosecution of Han Tak Lee rose, or fell, in large measure on the scientific proof regarding the source and origin of the fire that took the life of his daughter, Ji Yun Lee. Therefore, an appreciation of how that science has changed, and how the fundamental shift in our understanding of fire behavior over the past 20 years affects this case is essential to an understanding of the legal claims made in this petition.

¹Our description of these revolutionary changes in human understanding of fire science comes from those portions of the affidavit of John Lentini, a nationally renowned forensic scientist who specializes in arson detection, (Doc.45-1), that have been conceded by the Respondents to correctly summarize the state of the science in this field. (Doc. 72-1 “the Respondents have conceded the accuracy of paragraphs 7 through 26 of the 2005 Lentini affidavit.”) In addition, we have relied upon and summarized those portions of the testimony of Mr. Lentini that were presented at the May 27, 2014 hearing in this case and were uncontested by Respondents at that hearing.

At the time of the death of Ji Yun Lee in 1989, human understanding of the science surrounding determining the cause and origin of fires was incomplete, imperfect, and was marred by many misconceptions. At that time, arson investigators adhered to a commonly accepted, but erroneous, assumption that fires that were deliberately set through the use of hydrocarbon accelerants burned with a greater heat and intensity than fires of an accidental origin. This erroneous assumption, in turn, led to a series of equally erroneous conclusions that were widely accepted within the arson investigation scientific community regarding artifacts that could be recovered from fire scenes, artifacts which would provide proof that arson was the cause of a particular fire.

Believing that arson fires burned with a greater intensity and heat, investigators commonly concluded that the study of burn patterns in wood could reveal the use of accelerants and indicate deliberately set fire. In particular, in the late 1980's existing arson science pointed to the depth of charring of wood and the presence of "alligatoring," or large shiny charred blisters on burned wood, as indicative of arson fires. Indeed, by studying char patterns, arson investigators believed that they could identify the precise points of origin of a deliberately set fire. At the time this case began in 1989, arson investigators also frequently held that indications of melted metal in bed frames, and the presence of "crazed" glass, glass bearing small distinctive cracks

and fissures, were evidence of the intense heat generated by arsons. Furthermore, because it was believed that arson fires burned at a greater heat and intensity, much of the science of arson investigation in the 1980's entailed analysis of the heat and energy that were the product of what were assumed to be arson fires, and a comparison of that estimated heat to the heat and energy believed to be produced by a “normal” fire.

In the 1980's the science of arson investigation was also hobbled by an incomplete and inaccurate understanding of another fire scene phenomenon known as “flashover.” Flashover results when the presence of super-heated gases at a fire scene reach a critical intensity, causing all combustible materials within the fire scene to ignite simultaneously. Flashover can thus cause a fire within a room to suddenly, spontaneously, and catastrophically engulf all flammable surfaces in that room. At the time of the prosecution of Han Tak Lee the phenomenon of flashover was poorly understood in the arson science community. Flashover was believed to be a rare occurrence, and was thought to leave a signature at a fire scene which could be distinguished from the tell-tale signs of arson.

Thus, the arson investigators who approached the case of Han Tak Lee in 1989 did so confident in their understanding of how arson could be detected, and with their view of fire behavior and arson detection defined by the tenets of a professional orthodoxy which led them to conclusions that they presented with scientific certitude.

This scientific certitude not only colored the prism through which the prosecution viewed this case; it also hobbled the defense. Indeed, Lee's 1990 criminal defense counsel has previously testified that the general acceptance of these tenets in the arson investigation community at the time of Lee's 1990 trial prevented him from challenging this asserted scientific proof at trial. Han Tak Lee v. Tennis, 4:08-CV-1972, 2010 WL 3812160, 8*-9* (M.D. Pa. Sept. 22, 2010). Thus, for both the prosecution and the defense their view of this evidence was limited and defined by what were then the horizons of human knowledge regarding the behavior of fire.

And we now know that they were wrong.

Over the past two decades, there has been a revolution in fire science. It is a revolution that has toppled old orthodoxies, and cast into doubt longstanding assumptions regarding fire scene analysis. In the past twenty years, the analytical paradigm in arson investigations has shifted in profound and dramatic ways. Indeed, as presented by Petitioner, and conceded by Respondents, the scope of change in this field of human scientific endeavor has been global, sweeping and breathtaking.

For example, the premise upon which much of the prior art and science was based in this field—that arson fires burned with a greater heat and intensity than “normal” fires—has now been thoroughly debunked. It is now understood that the principal determinant of the heat and intensity of a fire is a natural element, the oxygen

which fuels the fire, and not some artificial accelerant. In short, ventilation rather than criminally violent motivation determines the heat and intensity of fires.

With this central tenet of the prior science in this field now invalidated, much of the past conventional wisdom regarding fire analysis has also been abandoned or reexamined. It now is widely understood that analysis of fire intensity tells us very little about whether a particular conflagration was deliberately set. Further, arson investigators have come to realize that flashover, a phenomenon previously regarded as rare, is commonplace in fires. This recognition also shifted the fire analysis paradigm in profound ways since flashover frequently results in precisely the type of burning patterns and charring that were previously ascribed to arsons. Thus, much of what was once regarded as physical evidence of a deliberately set fire is now understood to be a common consequence of all fires. Further, modern science has determined that some artifacts, like “crazed” glass, that were initially deemed to be evidence of a rapid intense increase in heat resulting from a deliberately set fire are, in fact, produced by the cooling of materials after a fire has occurred.

The impact of this tidal shift in our understanding of fire science over the past two decades has been profound, and profoundly affects the reliability of past fire science evidence. These extraordinary developments in fire science have not only undermined the validity of the past science and art in this field; they have also revealed

that what was once regarded as the science in this field was not only simply wrong, it was in some instances affirmatively misleading. For example, at the May 27, 2014 hearing in this case the Petitioner's expert witness, Mr. Lentini, testified without contradiction to the potentially powerful misleading quality of this past art and science. According to Mr. Lentini, recent studies have shown that when arson investigators used the prior art to try to determine the quadrant within a room that was the site of origin for a fire, the application of that prior art led to error rates of 90% or more. (Doc. 77, Testimony of John Lentini.) This testimony, which was not disputed by Respondents, is profound. It indicates that the application of this prior, discredited art to fire scene investigations could lead to erroneous conclusions regarding fire origin from arson experts at a rate which was greater than one would have achieved through random guessing.

The goal of science is the systematic pursuit of knowledge through the rigorous testing and empirical analysis of hypotheses. In science only those hypotheses whose validity can be empirically proven survive. Through this scientific method, we are assured that the hypotheses that we use to examine events occurring around us have legitimate predictive power. Judged against these benchmarks, there is now substantial evidence which suggests that what was thought to be science in the field of arson investigation in the late 1980's was little more than supposition and superstition.

However, this knowledge, which has been hard-earned over the past two decades, was unavailable to those who investigated the death of Ji Yun Lee in 1989, and defended Han Tak Lee at trial in 1990. Instead, they approached the death of Ji Yun Lee earnestly and in good faith, but with the horizons of their understanding limited by these past flawed orthodoxies.

B. The Life and Death of Ji Yun Lee

In the summer of 1989, the last summer of her short life, Ji Yun Lee lived with her father, Han Tak Lee, and their family in a Korean-American neighborhood in Elmhurst, New York. Ji Yun Lee had been troubled throughout her life by profound mental illness. As a teen she had been hospitalized for six months, (Doc. 75-7, p.9), and had experienced episodes of both suicidal and homicidal ideation. (*Id.*, pp.8-10.) She had also undergone electroshock therapy, and her medical records revealed signs of organic brain injuries. (*Id.*, pp.12-16.) Furthermore, Lee had been prescribed a psycho-tropic medication, lithium, in an effort to curb her violent mood swings, but autopsy results suggested that, at the time of her death, she may not have been compliant with her medications, further exacerbating her fragile mental health. (*Id.*, pp.4-7.)

In the days immediately preceding her death, Ji Yun Lee exhibited increasingly erratic and violent behavior. Thus, at 4:20 a.m. on July 28, 1989, police in Elmhurst,

New York, came upon Lee's father's retrieving personal family articles which his daughter had hurled from the Lee residence into the street. (Doc. 75-2.) Pausing to investigate, police heard Ji Yun Lee shouting. Entering the Lees' apartment in the triplex where they lived, police encountered Ji Yun Lee in a "hyper" (id., p.29), manic state, arguing with her family, who were urging her to take her medications. (Id., pp.29-35.) Notably, while police observed evidence of violent behavior by Ji Yun Lee, who had destroyed family property, they discerned no violence directed at Lee by her family. Instead, the police at the scene agreed that Ji Yun Lee's family were "all trying to help this child." (Id., p.33.)

Seeking solace, respite and answers to the riddle of his daughter's mental health, at the suggestion of their pastor, Han Tak Lee and Ji Yun Lee traveled to Camp Hebron, a religious retreat located in Monroe County, Pennsylvania, on July 28, 1989. (Doc. 75-7.) At Camp Hebron, Ji Yun Lee's erratic behavior continued. Upon arriving at the camp Ji Yun Lee left for a walk. After several hours she returned to her cabin soaking wet, having plunged into a nearby lake or pond. (Id., pp. 9-10.) Later on the evening of July 28, 1989, when clergy gathered at the cabin that Han Tak Lee and Ji Yun Lee shared to pray with the family, Ji Yun Lee reportedly became agitated and had to be physically restrained. (Id., pp. 12-15.)

In the early morning hours of July 29, 1989, Ji Yun Lee died when the cabin she shared with her father was engulfed in flames. The cause of Ji Yun Lee's death was recorded by the coroner as "conflagration," which meant that "a person is incinerated, basically, beyond recognition; where all combinations of fire, carbon monoxide, smoke, heat, completely disintegrate the body to the point where it becomes unrecognizable." (Doc. 75-2, p. 5.) While this much is known, with the acknowledged collapse of much of the scientific arson evidence presented at trial many aspects of the circumstances of Ji Yun Lee's death are now shrouded in confusion and uncertainty.

For his part, Han Tak Lee provided police with statements and gave testimony at his trial detailing his account of the events of July 29, 1989. (Docs. 75-3 and 75-7.) While these accounts have varied over time in some details, Lee has consistently stated that he awoke in the early morning hours of July 29, to find the cabin on fire. According to Lee he fled and re-entered the cabin several times, calling out to his daughter, and retrieving personal effects from the burning building. (*Id.*) Lee testified that Ji Yun Lee never responded to her father's calls, and he was unable to locate her in the structure as it became engulfed in flames. (*Id.*) Lee also reported that as he searched the cabin, he slipped and fell in a puddle of some unidentified liquid. (*Id.*)

C. The Investigation and Prosecution of Han Tak Lee

Police and fire first responders arrived at the scene of this cabin fire shortly after 3:00 a.m. on July 29, 1989. (Doc. 75-1.) At that time they found the cabin fully engulfed in flames, with electrical lines leading to the cabin severed and arcing sparks. (Id.) Informed by bystanders that someone might still be inside the structure, police and volunteer firemen attempted to gain entry to the building, but were repelled by the intense heat and flames. (Id.) Only after the fire was extinguished were authorities able to recover the remains of Ji Yun Lee, which were found huddled inside the cabin.

Arriving at the scene, police located Han Tak Lee outside the burning structure, along with the possessions and luggage he had retrieved from the cabin. The initial police officer on the scene was struck by Lee's impassive demeanor, which he construed as an air of nonchalance, (id., p.12),² and Lee swiftly became a focus of the police investigation, investigation that culminated in 1990 with Lee's prosecution and conviction.

1. Scientific Analysis of the Fire Scene Evidence

The course of Lee's case from this initial suspicion to his ultimate conviction was driven in large measure by the application of what are now conceded to be flawed scientific principles to the investigation of this fire scene. This process began within

²At trial Lee's counsel presented evidence that the stoic demeanor exhibited by Lee in the face of this tragedy was not a product of nonchalance, but was a cultural convention within the Korean community. (Doc.75-6.)

hours of the fire, on July 29, 1989, when Thomas Jones, the State Police Fire Marshal, conducted an examination of the charred ruins of the cabin in which Ji Yun Lee had died. As Jones later testified in the course of this examination he uncovered artifacts which he viewed through the prism of his understanding of the pathology of fire to be evidence of arson. (Docs. 15-5, pp.7-100; 15-6, pp.1-47.) Specifically, Fire Marshal Jones described locating a total of eight or nine burn patterns throughout the cabin, patterns marked by deep charring, and “alligator” charring, which he construed to be evidence of arson. (*Id.*) Jones also reported identifying “crazed” glass in the window panes of the cabin, (Doc. 15-5, p. 40), finely fractured glass panes which he also believed to be evidence of a deliberately set fire. Jones testified that all of these burn patterns, alligator charring and crazed glass were artifacts which were consistent with the use of accelerants to deliberately set a fire. Relying upon this burn pattern evidence and charring, Jones concluded that there were eight or nine separate identifiable points of origin for this fire, and that these independent points of origin were located throughout the cabin. Jones also opined that this was an incendiary fire which had been deliberately set.

This testimony was a critical component of the Commonwealth’s case since it was powerfully persuasive proof of arson, in that it indicated that someone intentionally started at least eight different fires within the structure in a rapid

succession. (*Id.*) Included among these burn patterns which led Jones to identify eight deliberately set fires within the cabin was burn pattern found at the front door of the cabin, (Doc. 15-6, p. 5), a finding which also suggested that the arsonist had acted in a particularly calculated fashion, setting fire to the escape path in the cabin, and effectively entombing Ji Yun Lee within a wall of flames. In his testimony Jones also dismissed an accidental flashover as a possible cause of these burn patterns, testifying in a fashion consistent with the then-existing art in this field that arson fires could be distinguished from the damage caused by a flashover. (Doc. 15-6, pp. 4-5.)

Jones' trial testimony makes it unmistakably clear that his conclusion that this was a deliberately set fire rested entirely upon his analysis of the burn patterns and charring in the structure, a form of scientific analysis which the Respondents have chosen to no longer defend as scientifically valid. In fact, Jones testified that, when he took samples of the charred wood from these burn patterns and submitted them for chemical analysis, no evidence of chemical accelerants was recovered from any of the sites where it was alleged that this fire was deliberately set. (Doc. 15-6, pp.8-9.)³ Thus, Jones cited to no other independent scientific evidence beyond the now discredited

³ While discovering no evidence of chemical accelerants at any of the sites where he alleged that this fire was deliberately set using such accelerants, Fire Marshal Jones did testify that chemical testing revealed some evidence of accelerants on Lee's clothing and in a melted plastic bottle found in the cabin. As discussed *infra*, however, the validity of this evidence has been now also been substantially undermined.

burn pattern analysis to support his finding of at least eight deliberately set fires inside this small cabin.

The testimony of Fire Marshal Jones was supported at trial by a second Commonwealth expert witness, Daniel Aston. Testifying that he had “probably experienced some 15,000 fires that I have been called upon to determine the cause for”, (Doc. 15-7, p.13),⁴ Aston described for the jury his own independent examination of the fire scene and fire scene evidence in October of 1989. Relying upon the same form of burn pattern analysis used by Fire Marshal Jones, Aston testified with great certainty that burn patterns in the cabin revealed eight or nine deliberately set fires using an accelerant. (Doc. 15-7, pp. 21,22, 59, 60, 77, 79, 93; Doc. 15-8, pp. 6, 58.) Aston also added chilling detail, cloaked in science, to this factual narrative of a deliberately set fire, alleging that he concluded the last fire was set at the front door of the cabin and stating: “He left the structure, and probably lit it from the outside at that point.” (Doc. 15-8, p. 58.) Thus, in Aston’s scientific presentation he used what is now discredited burn pattern evidence to describe a cruelly calculated scenario in which the arsonist’s

⁴This assertion gave Mr. Aston’s expert opinion testimony a particularly compelling scientific cachet for a jury but, upon reflection, may be difficult to fully credit since in order to determine the cause of 15,000 fires Aston would have had to have averaged one fire cause determination per day for more than 41 years while working 7 days a week, and 365 days each year.

last act was to create a wall of flames at the cabin's exit, trapping the victim inside the burning structure and deterring rescuers from saving her.

Aston further bolstered this scientific testimony through another form of fire origin analysis which Petitioner and Respondents now concede has been debunked. Asserting that arson fires burned at a greater heat and intensity, Aston provided the jury with a detailed analysis of the heat and energy that were the product of what he alleged was this arson fire, and then compared the estimated heat of this fire to the heat and energy he believed would have been produced by a "normal" fire. (Doc. 15-7, pp.80-85, Doc. 15-8, pp.55-58.) While the parties now concede that the premise behind this analysis, which relied upon the notion that arson fires burn with greater heat, is deeply flawed, at trial Aston presented this evidence without contradiction and with a compelling mathematical specificity. Indeed, Aston's calculations were so extraordinarily precise that he testified that he could estimate the weight of the entire cabin structure to within one hundredth of a pound, (Doc. 15-7, p.83), and Aston claimed that his mathematical calculations allowed him to determine with precision both the amounts and types of accelerants used to set this fire, 62 gallons of home heating fuel, mixed with 12.2 pounds, or gallons, of gasoline or Coleman fuel. (Doc. 15-8, pp. 55-58.)⁵

⁵ Under cross examination, Aston's testimony described the gasoline component of this combustible mix that he mathematically derived from his fire

2. Chemical Analysis of the Evidence

This flawed fire science evidence constituted the principal pillar of proof tying Lee to this arson fire and the death of his daughter by conflagration. Further, this burn pattern analysis was not directly supported by any other independent chemical testing since the chemical analysis of the suspected fire origin sites did not reveal any sign of the more than 60 gallons of gas and fuel oil that it was estimated were used by Lee to set this fire. (Doc. 52-5, pp.23-4, Doc. 15-6, pp. 8-9.)

Notwithstanding the absence of this evidence, The Commonwealth's case was bolstered in part through a second scientific pillar, the expert testimony of Thomas Pacewicz, a state police chemist who had conducted a gas chromatography⁶ analysis of three items of evidence: the shirt and pants worn by Lee on the night of the fire and

analysis at various times both in terms of pounds, (*Id.*, p. 56) and gallons. (*Id.*, p.57.) Aston's testimony did not explain, however, and no other evidence presented at trial readily explained where, or how, Lee could have managed to find and use a vessel large enough to hold more than 60 gallons of gasoline and heating fuel, allowing him to produce this volatile mixture, place it in at least eight locations within the cabin, ignite it in a fashion that was lethal to his daughter, but safe to himself, and leave no chemical trace of its existence at the eight burn sites identified as sources of origin for this fire.

⁶Gas chromatography is a method that is used in chemistry to separate the component parts of a volatile solution and measure their relative qualities. The tool used to measure these volatile solution components is a gas chromatograph, and the process of gas chromatography, which has evolved over time, typically involves heating substances containing these solutions, and then measuring the component elements of the solution once they are in a vapor form.

a partially burned plastic jug and latex glove recovered from the fire scene. (Doc. 52-5.)

While conceding that he found no evidence of accelerant at the sites of origin identified by the prosecution fire origin experts, (Doc. 52-5, pp.23-4), Pacewicz testified that his analysis of Lee's shirt, pants, and a burned jug found in the cabin all revealed the presence of hydrocarbons that "ranged from C-7 to C-22." (Doc. 52-5, pp. 12, 20.) Pacewicz's testimony, which was based upon the gas chromatography technology which was available to him in 1989, suggested that the results of the tests performed on all three of these samples were chemically the same and were consistent with a mixture of gasoline, kerosene, Coleman fuel, and fuel oils. (Doc. 52-5, pp. 13-20.) Thus, Pacewicz's testimony corroborated the testimony of the fire scene expert, Aston, who theorized that this precise mix of chemicals, in a quantity exceeding 60 gallons, was used to burn the cabin and kill Ji Yun Lee. This testimony also indicated that this precise mixture of chemicals was found on both Lee's shirt and pants, and at the fire scene, evidence which powerfully tied Lee to this crime.

In its closing argument, the Commonwealth emphasized this scientific evidence as further compelling proof of the commission of a calculated, and lethal arson by Lee, arguing:

You know from common sense that this fire was started effectively.
Whoever did this knew what they were doing. How do you know that?

You know because there was a mixture of accelerants. And that is an important point I want to raise in some detail with you. You remember Thomas Pacewicz told you that the accelerants found on the glove and on the jug and found on Mr. Lee were a mixture. He said it was a fuel oil mixture and it was mixed with either gasoline or Coleman Fuel. He told you you couldn't tell which of those two other types of gasoline it was because the gas chromatograph dips and peaks overlapped, but he did tell you that it was a mixture of fuel oil and something, another accelerant in the gasoline or Coleman Fuel range. ...

Could a crazy, suicidal girl, a mental patient, have the sense to state, in a moment of homicidal tendency, "I want to burn this house down, kill myself, kill my father, and fuel oil doesn't work too well; so, I'm going to mix it to make this an effectively burning fire"? Can you believe that? And yet, crazy enough to burn herself and burn down the place around her? The person who set this fire knew what he was doing.... (Trans. pp. 872-873)

* * *

... [A]nother fact which proves the Commonwealth's case and disproves the defense theory that this was committed by the victim was that the defendant's clothing contained a substance. Now, Mr. Rosenblum is telling you, "What does that mean?" True, we don't know from where the accelerant came; except, it had to come from the pants and shirts [sic] because, as you heard, they're all stirred into a can and then the vapor, through heat, comes up through the gas chromatograph device. It shows you that the accelerants in the defendant's clothing, whether gallons or droplets on him, were sufficient to show a reading which indicated the same mixture indicated in the glove and jug, the fuel oil mixed with either gasoline or Coleman Fuel. *Definitely, a mixture of those two general types of accelerants* (Trans. p. 883) (emphasis added). What are the chances that defendant just happened to slip and fall on the very same thing that was found in the bathroom, the jug and the glove, and not get injured from it? (Trans. p. 883).

(Doc. 45-1. P. 10, quoting trial transcript.)

Thus, the fire origin evidence, coupled with this chemical analysis presented at trial, was compelling and painted a picture for the jury of a deliberately set fire, ignited in a particularly methodical fashion, using a specific mixture of accelerants, a combination of accelerants found on a jug at the fire scene and also located on both Lee's shirt and pants.

3. The Commonwealth's Remaining Proof at Trial

Beyond this fire science evidence, the case against Han Tak Lee rested on thin reeds at trial. Thus, the Commonwealth's remaining proof consisted of minor discrepancies in Lee's accounts of the fire, accounts that were often translated for police from Korean to English by various bystanders in the hours immediately after the fire. In addition, the Commonwealth cited Ji Yun Lee's disruptive behavior at the Lee home in Elmhurst New York, the day before her death as a possible motive for this arson-murder. However, given that police at the scene described Ji Yun Lee as "hyper" and agreed that Ji Yun Lee's family were "all trying to help this child," (Doc. 75-2, p.33), this, too, seemed a thin reed upon which to support a murder charge. Further, the Commonwealth presented testimony regarding Lee's stoic nature in the face of his daughter's death, stoicism that was construed by one policeman as nonchalance, but which other evidence indicated may have simply reflected Korean cultural conventions when confronted by tragedy.(Compare Doc. 75-1, p.12 with Doc. 75-6.)

Finally, the Commonwealth's evidence included the autopsy findings for Ji Yun Lee, but these findings were also highly equivocal. The cause of Ji Yun Lee's death was officially recorded by the coroner as "conflagration," which meant that "a person is incinerated, basically, beyond recognition; where all combinations of fire, carbon monoxide, smoke, heat, completely disintegrate the body to the point where it becomes unrecognizable." (Doc. 75-2, p. 5.) Beyond this official cause of death, a forensic pathologist noted that the low levels of carbon monoxide in Lee's bloodstream suggested that she had ceased breathing almost immediately after she confronted the fire. This finding, in turn, led to one of two further conclusions regarding the precise cause of death: "One, that one was faced with a flash fire, so to speak; one walked into a wall of flame, or was overcome by a wall of flame." (Doc. 75-3, 13.) This proposed cause of death was consistent with the coroner's finding of death by conflagration, but added nothing to an understanding of whether the conflagration which took Ji Yun Lee's life was accidental or deliberately set.

The second possible conclusion reached by the forensic pathologist had a more sinister quality to it, and entailed the possibility that Ji Yun Lee, "may well have been incapacitated by some other means," such as strangulation, at the time of her death. (Doc. 75-3, p.14.) This more sinister interpretation of the cause of Lee's death, however, drew only scant forensic support from the evidence. In fact, the only

evidence consistent with this cause of death, incapacitation by strangulation followed by incineration, cited by the forensic pathologist was “tiny hemorrhages about the voice box.” (Doc. 75-3, p.15.) However, the forensic pathologist conceded that this was meager evidence supporting this theory since he admitted that the autopsy revealed only “minimal” soft tissue injury to Lee, (Doc. 75-3, p. 27), and stated that petechiae, or pinpoint hemorrhages of the capillaries which frequently accompany strangulation, “absolutely were not present” on the victim. (Doc. 75-3, p.29.)

D. Lee’s Conviction and Initial Post-Conviction Proceedings

Presented with this apparently immutable fire science evidence, on September 17, 1990, a jury convicted Lee of both arson and first degree murder in connection with the death of his daughter. Lee was sentenced to a mandatory life term of imprisonment without parole and began a series of post-conviction proceedings in state and federal court, proceedings which have encompassed the past two decades.

As these post-conviction proceedings began to wend their way through the state and federal courts, revolutionary developments in arson science also began to increasingly erode the scientific evidence underpinning of this conviction. Lee’s post-conviction proceedings, therefore, focused upon a critical reassessment of this evidence in light of the new insights gained through science, and invited the courts to reexamine this conviction in light of this new understanding of arson and fire detection science.

At first, the courts were reluctant to accept this invitation. Thus, in state court post conviction proceedings:

The Court of Common Pleas . . . ultimately denied [Lee's] petition for PCRA relief. In affirming the denial of Lee's PCRA petition, the Superior Court of Pennsylvania concluded that the Lentini affidavit [which presented the new scientific evidence in this field] would be "used solely to impeach the Commonwealth's experts' credibility and to contradict their opinion that the fire was of incendiary origin." App. at 67. The court also "reject[ed] Lee's assertion that the Commonwealth's methodology [for arson investigation] was scientifically invalid" because Lentini's affidavit "merely challeng[ed] the varying degrees of significance that are attributed to the generally accepted components of arson investigation." App. at 72–73. Under Pennsylvania law, "[a] new trial may be granted on the theory of after discovered evidence only if the new evidence ... [, *inter alia*,] will not be used solely for impeaching the credibility of a witness." App. at 66. This was the reason given by the Superior Court to deny relief on this claim. The Superior Court of Pennsylvania then denied Lee's application for reconsideration or re-argument en banc, and the Supreme Court of Pennsylvania denied Lee's application for allowance of appeal.

Han Tak Lee v. Glunt, 667 F.3d 397, 401-02 (3d Cir. 2012).

Adopting the deferential standard of review frequently imposed by statute upon state court post-conviction findings, the federal district court, Muir, J., also initially declined to consider how the progress of science had undermined the reliability of the verdict in Lee's case, concluding instead that "that no evidentiary hearing was warranted because 'Lee's claims of newly discovered evidence were presented to the Pennsylvania Courts in his PCRA petition, and affirmed on appeal.' The District Court noted the Superior Court's conclusion that 'the after-discovered evidence that

would have been used solely for impeachment purposes [did] not warrant a new trial under Pennsylvania law.’ ” Han Tak Lee v. Glunt, 667 F.3d 397, 402 (3d Cir. 2012).

E. The Court of Appeals’ Judgment Remanding this Case

Lee appealed this decision to the United States Court of Appeals for the Third Circuit, which reversed this judgment, and remanded this case for discovery and further evidentiary proceedings. Han Tak Lee v. Glunt, 667 F.3d 397 (3d Cir. 2012). That appellate decision defined for us the law of the case, and charted the future course of this litigation. In its ruling, the court of appeals concluded that Lee was entitled to further discovery regarding his claims concerning the invalidity of the prior fire science evidence submitted to the jury in this case. Id. at 405. The court also noted that the limitations on the scope of our review of state court decisions that typically apply in a post-conviction context:

do[] not apply to federal claims that have not been adjudicated on the merits in state-court proceedings, in which case § 2254(e)(2) is controlling. Id. at 1401. It provides:

If the applicant has failed to develop the factual basis of a claim in State court proceedings, the court shall not hold an evidentiary hearing on the claim unless the applicant shows that—

(A) the claim relies on—

(i) a new rule of constitutional law, made retroactive to cases on collateral review by the Supreme Court, that was previously unavailable; or

(ii) a factual predicate that could not have been previously discovered through the exercise of due diligence; and

(B) the facts underlying the claim would be sufficient to establish by clear and convincing evidence that but for constitutional error, no reasonable factfinder would have found the applicant guilty of the underlying offense.

Han Tak Lee v. Glunt, 667 F.3d 397, 405 (3d Cir. 2012).

Finally, the court of appeals defined for us the standard Lee must meet to obtain federal habeas corpus relief in this matter, stating that:

To succeed, Lee must show that the admission of the fire expert testimony “undermined the fundamental fairness of the entire trial,” Keller v. Larkins, 251 F.3d 408, 413 (3d Cir.2001), because “the probative value of [the fire expert] evidence, though relevant, is greatly outweighed by the prejudice to the accused from its admission.” Bisaccia v. Attorney Gen., 623 F.2d 307, 313 (3d Cir.1980) (quoting United States ex rel. Bibbs v. Twomey, 506 F.2d 1220, 1223 (7th Cir.1974)).

Han Tak Lee v. Glunt, 667 F.3d 397, 403 (3d Cir. 2012).

Guided by this mandate, we have both overseen post-conviction discovery, and conducted an evidentiary hearing aimed at resolving any remaining factual issues in this case. As a result of these proceedings, the legal claims and defenses of the parties are now sharply defined, and what remains of the evidentiary support for Lee’s 1990 conviction is clearly understood.

F. Proceedings on Remand from the Court of Appeals

At the outset, these proceedings on remand have resulted in an agreement by both Petitioner and Respondents that the fire science evidence presented by Fire

Marshal Jones and Mr. Aston no longer enjoys any scientific validity and cannot be relied upon to support the verdict in this case, a verdict which resulted in a mandatory life sentence for Lee. Thus, it is conceded that this major pillar of proof in the Commonwealth's case rested upon shifting sands which have now been eroded by the passage of time and the progress of human knowledge.

With the collapse of this fire science evidence, the principal remaining shard of scientific evidence linking Lee to this arson, and the death Ji Yun Lee, was the gas chromatography evidence presented by Thomas Pacewicz, evidence which suggested that the results of the tests performed on Lee's shirt, pants and debris found at the fire scene were chemically the same and were consistent with a mixture of gasoline, kerosene, Coleman fuel, and fuel oils. (Doc. 52-5, pp. 13-20.) With respect to this last principal scientific pillar of proof in the Commonwealth's case, proceedings on remand revealed that time, and science, have substantially undermined the persuasive power of this proof.

At the outset, we learned that while the items tested by Pacewicz still existed the results of those tests conducted by Pacewicz could no longer be found. Thus, the Commonwealth has candidly acknowledged that, after more than 20 years, the original gas chromatograms produced by Pacewicz in his testing of this evidence can no longer be located. In short, with the passage of time, this evidence—the only original evidence

revealing the precise result of this gas chromatograph testing—has been lost and the actual results obtained through this initial testing can no longer be examined.

While we acknowledge the loss of this important evidence some two decades after Lee’s conviction, we find nothing intentional or culpable about this loss, which the Commonwealth has candidly acknowledged. Indeed, we note that, throughout these proceedings, the Commonwealth has acted with great candor, conceding the collapse of its prior fire science evidence, diligently searching for items of evidence, and cooperating in the testing of that remaining evidence. Accordingly we do not draw any spoliation inference from the loss of this evidence. “For the [spoliation] rule to apply ... it must appear that there has been an actual suppression or withholding of the evidence. *No unfavorable inference arises when the circumstances indicate that the document or article in question has been lost or accidentally destroyed, or where the failure to produce it is otherwise properly accounted for. . . .* Therefore, a finding of bad faith is pivotal to a spoliation determination. This only makes sense, since spoliation of documents that are merely withheld, but not destroyed, requires evidence that the documents are actually withheld, rather than—for instance—misplaced. Withholding requires intent.” Bull v. United Parcel Serv., Inc., 665 F.3d 68, 79 (3d Cir. 2012). Yet, while we decline to make any spoliation inference, we note that, with the loss of this original evidence the factual underpinning of the Commonwealth’s case

is eroded in yet another important respect, since it appears that the Commonwealth can no longer prove what Pacewicz alleged in Lee's 1990 trial by producing these gas chromatograms.

This gap in the Commonwealth's proof is further compounded by two concessions made by the Commonwealth's own expert witness, State Police forensic scientist Clyde Liddick, at the May 27, 2014 evidentiary hearing conducted by this court. At that hearing, Mr. Liddick advised the court that the gas chromatography technology that was available to Mr. Pacewicz in 1989 was less accurate and reliable than the technology currently in place, technology which the Petitioner was able to use to conduct recent tests of the remaining physical evidence in this case.

In addition, Mr. Liddick, the Respondents' expert witness, testified in another way that severely undercut the probative value of Pacewicz's 1990 trial testimony that his analysis of Lee's shirt, pants, and the burned jug found in the cabin revealed the presence of hydrocarbons that "ranged from C-7 to C-22." (Doc. 52-5, pp. 12, 20.) Contrary to the suggestion at the 1990 trial that the presence of hydrocarbons that "ranged from C-7 to C-22," described very similar hydrocarbon compounds, Mr. Liddick advised the court that a wide array of compounds, including even some forms of carpeting, have gas chromatograph profiles that range from C-7 to C-22. In the face of this testimony, and in the absence of Pacewicz's original gas chromatograph

recordings, the probative force of this 1990 scientific evidence was further diminished to a dramatic degree.

Finally, at this May 27, 2014 hearing we were presented with the results of the recent gas chromatography testing of Lee's shirt, pants, and the fire scene debris undertaken by the Petitioner's expert, John Lentini, with a technology which the Respondent's expert, Clyde Liddick, acknowledged is more refined and accurate than that used in 1990. The results of this testing were not conclusive and left some questions unanswered, but constituted a serious blow to the Commonwealth's theory argued at trial that the gas chromatograph evidence: "shows . . . that the accelerants in the defendant's clothing, whether gallons or droplets on him, were sufficient to show a reading which indicated *the same mixture* indicated in the glove and jug, the fuel oil mixed with either gasoline or Coleman Fuel. Definitely, a mixture of those two general types of accelerants." (Doc, 45-1, p.10, emphasis added.)

The modern testing results conducted in this case, which are currently the only testing results which survive in the case, show no such thing.

Instead, the gas chromatograph results obtained from examination of these three remaining items of physical evidence show that the chemical hydrocarbon profiles of these three samples are entirely different from one another. (Doc. 45-1.) Thus, while this testing disclosed hydrocarbons with carbon numbers consistent with both fuel oil

and gasoline on Lee's shirt, that hydrocarbon profile differed from the analysis of Lee's pants, which found no evidence of either gasoline or any other heavy petroleum distillate on these trousers. These two test results, in turn, were completely inconsistent with the analysis of the melted jug and glove found in the fire debris, which bore a hydrocarbon profile that was consistent with fuel oil, but not consistent with gasoline. (Id.) In short, far from showing that an identical substance was found on Lee's shirt, pants and in the fire debris, as argued by the Commonwealth at trial, these recent test results indicated that the three substances that were previously detected by police are, in fact, quite dissimilar.⁷

⁷The Commonwealth's expert witness, Clyde Liddick, has critiqued the validity of this testing, suggesting that the passage of time could lead to degradation of the evidence in a number of ways which would make these test results unreliable. While we appreciate this critique we do not find that it undermines the reliability of this evidence for the following reasons: First, given the disappearance of Mr. Pacewicz's gas chromatograms, these test results are, in fact, the only test results available to the court and are, therefore, the best available evidence in this case. Indeed, we note that the Respondents have elected not to independently test these items. Second, the Petitioner's expert, John Lentini, accounted for these factors in his testimony and testing, reporting to the court that the samples arrived for testing in a pristine condition which diminished the likelihood of sample degradation, and further observing that while the passage of time might diminish the ability of the gas chromatograph to detect hydrocarbons, it should not lead to results which altered the basic chemical composition of any detectable hydrocarbons previously found on these exhibits. Therefore, if these items had an identical hydrocarbon profile in 1989, they should still have had consistent hydrocarbon analyses many years later. Accordingly, the discrepancies detected between the tested samples cannot be readily explained as a consequence of weathering, and the passage of time does not explain why items that Mr. Pacewicz described as similar in 1990, are now revealed to be very different.

It is against this fully-developed factual background⁸ that we are now called upon to answer the question posed by the court of appeals– whether Lee has “show[n] that the admission of the fire expert testimony ‘undermined the fundamental fairness of the entire trial,’ Keller v. Larkins, 251 F.3d 408, 413 (3d Cir.2001), because ‘the probative value of [the fire expert] evidence, though relevant, is greatly outweighed by the prejudice to the accused from its admission.’ Bisaccia v. Attorney Gen., 623 F.2d 307, 313 (3d Cir.1980) (quoting United States ex rel. Bibbs v. Twomey, 506 F.2d 1220, 1223 (7th Cir.1974)).” Han Tak Lee v. Glunt, 667 F.3d 397, 403 (3d Cir. 2012). For the reasons set forth below, we conclude that Lee has made this exacting showing and, therefore, is entitled to habeas corpus relief in the form of an order directing that this matter be remanded to the Court of Common Pleas of Monroe County with instructions to provide Lee with a new trial on these charges.

III. Discussion

A. State Prisoner Habeas Relief–The Legal Standard.

Finally, we note that Liddick himself agreed that the testing equipment used by Mr. Lentini was capable of more sophisticated and sensitive analysis than that possessed by Pacewicz in 1989, providing some greater measure of confidence in the accuracy of these test results.

⁸At the May 27, 2014 hearing conducted by this court all parties agreed that the factual record in this matter was now fully and completely developed.

A state prisoner seeking to invoke the power of this Court to issue a writ of habeas corpus must satisfy the standards prescribed by 28 U.S.C. § 2254, which provides in part as follows

(a) The Supreme Court, a Justice thereof, a circuit judge, or a district court shall entertain an application for a writ of habeas corpus in behalf of a person in custody pursuant to the judgment of a State court only on the ground that he is in custody in violation of the Constitution or laws or treaties of the United States.

(b)(1) An application for a writ of habeas corpus on behalf of a person in custody pursuant to the judgment of a State court shall not be granted unless it appears that--

(A) the applicant has exhausted the remedies available in the courts of the State;

.....

(2) An application for a writ of habeas corpus may be denied on the merits, notwithstanding the failure of the applicant to exhaust the remedies available in the courts of the State.

28 U.S.C. § 2254 (a) and (b).

As this statutory text implies, state prisoners must meet exacting substantive and procedural benchmarks in order to obtain habeas corpus relief. At the outset, a petition must satisfy exacting substantive standards to warrant relief. Federal courts may “entertain an application for a writ of habeas corpus on behalf of a person in custody pursuant to the judgment of a State court only on the ground that he is in custody in violation of the Constitution or laws or treaties of the United States.” 28 U.S.C. § 2254(a). By limiting habeas relief to state conduct which violates “the Constitution or

laws or treaties of the United States,” § 2254 places a high threshold on the courts. Typically, habeas relief will only be granted to state prisoners in those instances where the conduct of state proceedings led to a “fundamental defect which inherently results in a complete miscarriage of justice” or was completely inconsistent with rudimentary demands of fair procedure. See, e.g., Reed v. Farley, 512 U.S. 339, 354 (1994). Thus, claimed violations of state law, standing alone, will not entitle a petitioner to § 2254 relief, absent a showing that those violations are so great as to be of a constitutional dimension. See Priester v. Vaughan, 382 F.3d 394, 401-02 (3d Cir. 2004).

In conducting this analysis we also apply familiar standards of review:

Under the Antiterrorism and Effective Death Penalty Act of 1996 (“AEDPA”), “federal courts are to review a state court's determinations on the merits only to ascertain whether the state court reached a decision that was ‘contrary to’ or involved an ‘unreasonable application’ of clearly established Supreme Court law, or if a decision was based on an ‘unreasonable determination’ of the facts in light of the evidence presented.” Fahy v. Horn, 516 F.3d 169, 189 n. 20 (3d Cir.2008). But when “the state court has not reached the merits of a claim thereafter presented to a federal habeas court, the deferential standards provided by AEDPA ... do not apply.” Appel v. Horn, 250 F.3d 203, 210 (3d Cir.2001). “In such an instance, the federal habeas court must conduct a de novo review over pure legal questions and mixed questions of law and fact, as a court would have done prior to the enactment of AEDPA.” Id.

Thomas v. Horn, 570 F.3d 105, 113 (3d Cir. 2009).

Here, the court of appeals has already observed that Lee’s claims regarding the manner in which the march of human progress has undermined confidence in the

scientific proof underlying this verdict has never been assessed by the state courts. Han Tak Lee v. Glunt, 667 F.3d 397, 401-02 (3d Cir. 2012). Therefore, we apply a *de novo* standard of review in addressing these issues.

Further our assessment of this question is guided by case law over the past decade which has considered how these dramatic developments in arson detection science now effect post-conviction analysis of arson prosecutions. These cases have addressed this issue in a variety of factual contexts. Sometimes these questions arise in the context of ineffective assistance of counsel claims, where petitioners argue that counsel's performance at trial was constitutionally deficient in failing to challenge old arson orthodoxies based upon new scientific developments. See, e.g., Richey v. Bradshaw, 498 F.3d 344 (6th Cir. 2007); Dugas v. Coplan, 428 F.3d 317 (1st Cir. 2005), on remand, 506 F.3d 1 (1st Cir. 2007); United States v. Hebsie, 754 F.Supp.2d 89 (D. Mass 2010). In other instances, this issue has been addressed in determining whether a petitioner has made a sufficient threshold showing of actual innocence to excuse earlier procedural defaults or support a free-standing legal claim. See Albrecht v. Horn, 485 F.3d 103 (3d Cir. 2007). In still other instances, as in this case, the issue before the court has been a question of due process, an inquiry into whether the petitioner's "continued incarceration is unconstitutional because his convictions are predicated on what new scientific evidence has proven to be fundamentally unreliable

expert testimony, in violation of due process.” Han Tak Lee v. Glunt, 667 F.3d 397, 403 (3d Cir. 2012).

While these claims have been viewed through these different analytical lens, a legal consensus has emerged on several cardinal principles. First, courts increasingly recognize, and acknowledge, that the science of arson detection has undergone a tidal shift over the past two decades. Id. There is also an emerging consensus that, upon a proper showing by a habeas petitioner, this paradigm shift in our understanding of arson science may entitle petitioners to post-conviction relief. See, e.g., Richey v. Bradshaw, 498 F.3d 344 (6th Cir. 2007); United States v. Hebsie, 754 F.Supp.2d 89 (D. Mass 2010).

Case law also reveals the exacting showing which a petitioner must make in order to obtain post-conviction relief based upon this new scientific proof. As the United States Court of Appeals has aptly observed here: “To succeed, Lee must show that the admission of the fire expert testimony ‘undermined the fundamental fairness of the entire trial,’ Keller v. Larkins, 251 F.3d 408, 413 (3d Cir.2001), because ‘the probative value of [the fire expert] evidence, though relevant, is greatly outweighed by the prejudice to the accused from its admission.’ Bisaccia v. Attorney Gen., 623 F.2d 307, 313 (3d Cir.1980) (quoting United States ex rel. Bibbs v. Twomey, 506 F.2d 1220, 1223 (7th Cir.1974)).” Han Tak Lee v. Glunt, 667 F.3d 397, 403 (3d Cir. 2012).

In practice, there are two aspects to this analysis. First, we must assess the degree to which the now debunked scientific proof was a critical component of the government's evidence at trial. We must then assess whether, when this flawed and unreliable evidence is set aside, there remained "ample evidence" of guilt upon which the jury could have relied. Albrecht v. Horn, 485 F.3d 103, 126 (3d Cir. 2007). If the remaining evidence of guilt shows that the government's case has not been "meaningfully undermined" by the collapse of the fire science proof, then habeas corpus relief still may not be appropriate. Dugas v. Coplan, 506 F.3d 1, 13 (1st Cir. 2007).

While this is plainly a demanding burden of proof and persuasion, we find that Han Tak Lee has met his burden of showing a due process violation in this case, since the verdict in this matter rests almost entirely upon scientific pillars which have now eroded.

B. Lee Has Shown that the Admission of the Fire Expert Testimony Undermined the Fundamental Fairness of the Entire Trial Because the Probative Value of the Fire Expert Evidence, though Relevant, is Greatly Outweighed by the Prejudice to the Accused from its Admission.

We find in this case that Lee has "show[n] that the admission of the fire expert testimony 'undermined the fundamental fairness of the entire trial,' Keller v. Larkins, 251 F.3d 408, 413 (3d Cir.2001), because 'the probative value of [the fire expert]

evidence, though relevant, is greatly outweighed by the prejudice to the accused from its admission.” Han Tak Lee v. Glunt, 667 F.3d 397, 403 (3d Cir. 2012).

Our analysis of this issue begins with a consideration of the elements of the offenses for which Lee was convicted. Under Pennsylvania law, “[a] conviction for arson demands the establishment of three facts: (1) that there was a fire; (2) that it was of incendiary origin; and (3) that the defendant was the guilty party.” Commonwealth v. Colon, 264 Pa. Super. 314, 325, 399 A.2d 1068, 1073 (1979). Murder in the first degree, in turn, is defined under Pennsylvania law in the following terms:” A criminal homicide constitutes murder of the first degree when it is committed by an intentional killing.” 18 Pa. C. S. § 2502(a). Thus, under Pennsylvania law it is well-settled that:

“The elements of first-degree murder are that the defendant unlawfully killed a human being, the defendant killed with malice aforethought, and the killing was willful, deliberate, and premeditated.” Commonwealth v. Wesley, 562 Pa. 7, 753 A.2d 204, 208 (2000); Commonwealth v. Cox, 556 Pa. 368, 728 A.2d 923, 929 (1999), cert. denied, 533 U.S. 904, 121 S.Ct. 2246, 150 L.Ed.2d 233 (2001); see also 18 Pa.C.S. § 2502(a) and (d). The willful, deliberate, and premeditated intent to kill is the element that distinguishes first-degree murder from other degrees of murder. Commonwealth v. Wilson, 543 Pa. 429, 672 A.2d 293, 297 (1996), cert. denied, 519 U.S. 951, 117 S.Ct. 364, 136 L.Ed.2d 255 (1996). “[T]he Commonwealth can prove the specific intent to kill through circumstantial evidence.” Weiss, 776 A.2d at 963. “The use of a deadly weapon on a vital part of the victim's body may constitute circumstantial evidence of a specific intent to kill.” Id.; Commonwealth v. Bond, 539 Pa. 299, 652 A.2d 308, 311 (1995).

Commonwealth v. Drumheller, 570 Pa. 117, 141-42, 808 A.2d 893, 908 (2002).

Pennsylvania law also defines the relationship between arson and murder in cases involving fatal, deliberately set fires. “Where the conviction for first degree murder is based upon arson the Commonwealth must first establish that there was a fire of incendiary origin and that the accused deliberately caused the fire. Commonwealth v. Cockfield, 465 Pa. 415, 350 A.2d 833 (1976). The Commonwealth must then establish that the fire was the cause of death. Commonwealth v. Smallwood, 497 Pa. 476, 442 A.2d 222 (1982).” Commonwealth v. Pierce, 537 Pa. 514, 523, 645 A.2d 189, 194 (1994). Here, the elements of Lee’s offenses of conviction coalesce since Lee’s murder conviction was predicated upon a killing by arson. Therefore, it was incumbent upon the Commonwealth to first establish “that there was a fire of incendiary origin and that the accused deliberately caused the fire. The Commonwealth must then establish that the fire was the cause of death.” Id.

Considering these elements of proof in light of what now remains of the evidence in Lee’s state case, we find—and the parties concede—that substantial elements of what was once the Commonwealth’s essentially undisputed proof of these elements can no longer withstand the scrutiny of science. Specifically, we note that the first element of these offenses, that there was a fire of an incendiary origin, has been substantially undermined by these new developments in the field of arson science. Indeed, the Commonwealth candidly admits that the arson science testimony presented

at Lee's trial by Fire Marshal Jones and Mr. Aston—the only proof of the incendiary origin of this fire—is no longer reliable as an indication of arson. In the absence of this proof, therefore, there simply is no reliable evidence upon which a jury could find that this conflagration was a fire of incendiary origin.

Further, we conclude that the remaining scientific evidence in this case which was relied upon by the Commonwealth to meet its burden of proof on the second element of these offenses, that the accused deliberately caused the fire, is now cast into substantial doubt in ways which “‘undermine[] the fundamental fairness of the entire trial,’ Keller v. Larkins, 251 F.3d 408, 413 (3d Cir.2001), because ‘the probative value of [the] evidence, though relevant, is greatly outweighed by the prejudice to the accused from its admission.’” Han Tak Lee v. Glunt, 667 F.3d 397, 403 (3d Cir. 2012). In particular, we note that this fire origin evidence, coupled with this chemical analysis presented at trial, painted a compelling circumstantial picture of Lee's guilt for the jury by describing a deliberately set fire, ignited in a particularly methodical fashion, using a specific mixture of accelerants, a combination of accelerants found on a jug at the fire scene and also located on both Lee's shirt and pants. However, the Commonwealth now concedes that it cannot defend the scientific validity of the fire source testimony of Fire Marshal Jones, and Mr. Aston.

Further, the other scientific lynchpin in the Commonwealth's circumstantial case that Lee deliberately set this fire—the testimony of Mr. Pacewicz that a similar combination of accelerants was found at the fire scene and was also located on both Lee's shirt and pants—has been largely undermined. Indeed, the original evidence that supported this contention, the gas chromatograms produced by Pacewicz in his testing of this evidence, no longer exists. Therefore, at present, there is a complete failure of proof on this contested issue by the Commonwealth. Moreover, the probative value of the testimony of the state police chemist expert in 1990 that the presence of hydrocarbons that “ranged from C-7 to C-22,” described very similar hydrocarbon compounds, has been entirely undermined by the testimony of the current state police forensic witness, Mr. Liddick, who advised the court that a wide array of compounds, including even some forms of carpeting, have gas chromatograph profiles that range from C-7 to C-22.

Finally, the modern testing results conducted in this case, which are currently the only testing results in the case, show that the chemical hydrocarbon profiles of these three samples are entirely different from one another. (Doc. 45-1.) Thus, while this testing disclosed hydrocarbons with carbon numbers consistent with both fuel oil and gasoline on Lee's shirt, that hydrocarbon profile differed from the analysis of Lee's pants, which found no evidence of either gasoline or any other heavy petroleum

distillate on these trousers. These two test results, in turn, were completely inconsistent with the analysis of the melted jug and glove found in the fire debris, which bore a hydrocarbon profile that was consistent with fuel oil, but not consistent with gasoline. In sum, rather than showing that an identical substance was found on Lee's shirt, pants and in the fire debris, as argued by the Commonwealth at trial, these recent test results reveal that the three substances that were previously described as essentially identical are, in fact, quite dissimilar.

We also note that the extraordinary progress of fire science in the past two decades undermines the confidence which can repose in this verdict in yet another important way. In 1990, the conventional wisdom and misplaced scientific certitude regarding the validity of burn pattern evidence in arson investigations not only colored the prism through which the prosecution viewed this case; it also hobbled Lee's defense. Indeed, defense counsel has previously testified that the general acceptance of these tenets in the arson investigation community at the time of Lee's 1990 trial prevented him from challenging this asserted scientific proof at trial. Han Tak Lee v. Tennis, 4:08-CV-1972, 2010 WL 3812160, 8*-9* (M.D. Pa. Sept. 22, 2010). Thus, for both the prosecution and the defense their view of this evidence was limited and defined by what were then the horizons of human knowledge regarding the behavior of fire, horizons which we now know were distorted, and wrong. Therefore, while we

do not challenge the effectiveness of defense counsel based upon the state of the art in this field in 1990, we recognize that this science has fundamentally changed in ways which now permits a defense which was previously foreclosed by the limits of human knowledge, a defense disputing the incendiary origins of this fire.

Finally, as we assess whether, once this flawed and unreliable evidence is set aside, there remains “ample evidence” of guilt upon which the jury could have relied, Albrecht v. Horn, 485 F.3d 103, 126 (3d Cir. 2007), we are compelled to conclude that the Commonwealth’s case has been “meaningfully undermined” by the collapse of the fire science proof. Dugas v. Coplan, 506 F.3d 1, 13 (1st Cir. 2007). Without this scientific proof the Commonwealth’s trial evidence rests upon thin and equivocal reeds. Thus, the Commonwealth would be left to argue that its case, which is now largely bereft of scientific proof of the incendiary origin of this fire, may be proven beyond a reasonable doubt based upon alleged inconsistencies in the Korean-to-English interpretation of statements made by Lee in the hours following his daughter’s death; a cultural stoicism which was construed as nonchalance; a family dispute the day before Ji Yun lee’s death in which police agreed that Ji Yun Lee’s family were “all trying to help this child,” (Doc. 75-2, p.33); and autopsy results which agreed that Ji Yun Lee died from conflagration, but posited two alternate theories of this cause of death, one of which was wholly consistent with death in an accidental fire, and the

other of which was supported by very little forensic evidence. Individually, these shards of evidence are equivocal, and collectively they simply do not reach the quantum of proof, “ample evidence” of guilt upon which the jury could have relied, Albrecht v. Horn, 485 F.3d 103, 126 (3d Cir. 2007), which is necessary to deny habeas corpus relief under these circumstances.

Finding that Lee has “show[n] that the admission of the fire expert testimony ‘undermined the fundamental fairness of the entire trial,’ Keller v. Larkins, 251 F.3d 408, 413 (3d Cir.2001), because ‘the probative value of [the fire expert] evidence, though relevant, is greatly outweighed by the prejudice to the accused from its admission,’” Han Tak Lee v. Glunt, 667 F.3d 397, 403 (3d Cir. 2012), we conclude that Lee is entitled to relief in the form of an order conditionally granting the petitioner’s petition for writ of habeas corpus, vacating Lee’s conviction and sentence and directing the Commonwealth to either retry Lee within 120 days,⁹ or release the petitioner.

⁹“120-day period the District Court set for re-trial was ‘eminently reasonable.’ . . . (noting that 120 days comports with Pennsylvania's Rule of Criminal Procedure 600(D)).” Vazquez v. Wilson, 348 F. App'x 733, 734 (3d Cir. 2009). See Slutzker v. Johnson, 393 F.3d 373, 390 (3d Cir.2004) (120 days); Holloway v. Horn, 355 F.3d 707, 730 (3d Cir.2004) (120 days). See also Gibbs v. Frank, 500 F.3d 202, 207 (3d Cir. 2007)(collecting cases).

In reaching this result we conclude as we began. To achieve justice, the law must serve as the vehicle through which imperfect institutions strive for greater justice through a more perfect understanding of the truth. Therefore, as our understanding of scientific truth grows and changes, the law must follow the truth in order to secure justice.

IV. Recommendation

Accordingly, for the foregoing reasons, upon consideration of this Petition for Writ of Habeas Corpus filed pursuant to 28 U.S.C. § 2254, and the Response in Opposition to this Petition, IT IS RECOMMENDED that the Petition be CONDITIONALLY GRANTED, that Lee's conviction and sentence be vacated, and that the Commonwealth be directed to either retry Lee within 120 days, or release the petitioner.

The Parties are further placed on notice that pursuant to Local Rule 72.3:

Any party may object to a magistrate judge's proposed findings, recommendations or report addressing a motion or matter described in 28 U.S.C. § 636 (b)(1)(B) or making a recommendation for the disposition of a prisoner case or a habeas corpus petition within fourteen (14) days after being served with a copy thereof. Such party shall file with the clerk of court, and serve on the magistrate judge and all parties, written objections which shall specifically identify the portions of the proposed findings, recommendations or report to which objection is made and the basis for such objections. The briefing requirements set forth in Local Rule 72.2 shall apply. A judge shall make a de novo determination of those portions of the report or specified proposed findings or recommendations to which objection is made and may accept, reject, or

modify, in whole or in part, the findings or recommendations made by the magistrate judge. The judge, however, need conduct a new hearing only in his or her discretion or where required by law, and may consider the record developed before the magistrate judge, making his or her own determination on the basis of that record. The judge may also receive further evidence, recall witnesses or recommit the matter to the magistrate judge with instructions.

Submitted this 13th day of June, 2014.

S/Martin C. Carlson

Martin C. Carlson

United States Magistrate Judge